Cs and Vs or Moras: The case of Bukusu Prosodic Structure*

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0. Introduction.

One of the central issues dealt with in Hyman (1984; 1985) concerns the nature of the units which characterize the prosodic tier. Hyman (following Clements 1982, 1984; McCarthy 1979, 1982; Thráinsson 1978) pursues the question of whether it is theoretically viable to postulate both consonants (C's) and vowels (V's) as the elements which constitute the prosodic tier. Here's the basic question: Should Cs and Vs be given the same prosodic value?

Two subsequent studies -- Clements 1986 and Hayes 1989 -- respectively show the superiority of the CV and moraic theories over the classical SPE approach which failed to capture the relationship between processes like compensatory lengthening on the one hand, and glide formation, vowel contraction, and pre-nasal-consonant lengthening, on the other. These two theories share a number of features, but perhaps their most fundamental difference lies in their claims regarding the units which determine syllable weight, because where CV theory postulates Cs and Vs, the moraic theory adopts the *mora*. Evidence adduced across languages indicates that there are advantages and disadvantages to adopting either theory, because each theory has its strengths and weaknesses. Our task in this paper is not to try and resolve the dilemma faced by phonologists in this regard, but rather to examine a few prosodic structures in Bukusu which seem to favor the moraic theory over CV phonology.

I have divided my discussion into four parts. First, section 1 reviews the Bukusu system of prefixation with a view to highlighting the specific environments for the different phonological processes discussed later in the paper. It is shown, for instance, that each Bukusu noun (and adjective) contains two units in the prefix structure: a prefix and a preprefix. That the two be treated as separate units is essential for later arguments on haplology. Section 2 contains a brief background to the CV and moraic theories, especially their postulations regarding the units which constitute the prosodic structure. In section 3, I adduce evidence for the four processes which trigger compensatory lengthening (CL) as a preamble to the discussion of the problematic cases in section 4, where the predictive power of the CV and moraic theories is re-evaluated, especially with respect to syllable

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deleting processes. Finally, in section 5 we present a potential problem case -- y-epenthesis -- where the epenthesized glide seems to violate the prohibition against moraic glides.

1. Background

Bukusu, a Bantu language of Kenya, exhibits compensatory lengthening (henceforth, CL) caused by at least four phonological processes. Three of these processes -- glide formation (GF), vowel contraction (VC), and pre-nasal-consonant lengthening (PNC) -- are widely attested garden-variety rules which both CV and moraic theories handle quite satisfactorily. However, one phenomenon, syllable deletion, tips the balance in favor of moraic theory, especially following our demonstration that CV theory cannot account for such simple gliding as in **/u-ima/ ---> [wiima]** 'you sg.stand' without proposing an undesirable rule of C-epenthesis in the prosodic structure.

1.1 The Bukusu Prefix System

Nominal and adjectival prefixes will be examined simultaneously since there are no morphological or phonological differences between lexical noun prefixes and adjectival agreement prefixes. The survey will then examine verb structure.

1.1.1 Nouns and Adjectives

In general, a Bukusu noun consists of two parts: a prefix structure and a stem. The prefix structure is assigned in accordance with the class of the noun, as illustrated in (1). Generally, preprefix vowels are always identical to the vowel of the prefix, except cl.9/10[1] which have no prefix vowel. [UR = Underlying; is PR = Phonetic Representation]

(1)

UR	PR	Gloss	UR	PR	Gloss
u-mu-ndu	omuundu	'person cl.1'[2]	či-n-yofu	čiinjofu	'elephants cl.10'
ßa-ßa-ndu	ßaßaandu	'persons cl.2'	lu-lu-ala	lúlwaala	'finger cl.11'
ku-mu-saala	kúmusaala	'tree cl.3'	xa-xa-ala	xáxaala	'small finger cl.12'
ki-mi-saala	kímisaala	'trees cl.4'	ßu-ßu-oßa	ßußwooßa	'mushrooms cl.14'
li-li-anda	lilyaanda	'charcoal cl.5'	xu-xu-iča	xuxwiiča	'to come cl.15'
ka-ma-nda	kamaandu	'charcoal cl.6'	a-a-ndu	á.aandu[3]	'at place cl.16'
si-si-ndu	sisiindu	'thing cl.7'	mu-mu-ndu	mumuundu	'in(side) place cl.17'
ßi-ßi-ndu	ßißiindu	'things cl.8'	xu-xu-ndu	xuxuundu	'on place cl.18'
e-n-yofu	eenjofu	'elephant cl.9'	ku-ku-ala	kúkwaala	'big finger cl.20'
			e-_-Columbus	éColumbus	'at Columbus cl.24'

[1] These numbers were designed to capture the noun gender system where each noun prefix structure serves at least two functions: (i) it marks number, and (ii) it acts as a clue to the agreement structure that matches the noun class.

[2] The phonetic form shows a common process of vowel lengthening before nasal-consonant sequences, which we take up later in §3.3. Notice also that underlying /u/ surfaces as [o] word-initially. This is attributable to a rule that lowers underlying short nominal and subject prefixes word-initially (cf. fn 26).

[3] I use the period to show that adjacent vowels are heterosyllabic.

(1) contains two types of CVCV prefix structures: (i) those with identical syllables, and (ii) those with non-identical syllables. The first category is examined further in §3.4.

2.1.1 **Prefixes and Preprefixes**

For as start, let us consider the question of whether there is any justification in treating prefixes and preprefixes as separate units when, as the surface forms of the nouns in (1) indicate, the two components of the prefix structure always surface together. To answer this question, we must consider evidence from elsewhere in the grammar which shows that a prefix can occur on a lexical item without the corresponding preprefix, and vice versa. One such case involves the "Which X?" construction, as in (2), where "X" is a noun variable. Since preprefix omission does not yield bad forms, the conclusion is that the two syllables are autonomous units. Besides, the unacceptable forms in (3) show that the preprefix cannot replace the prefix, that is, they are not interchangeable components.

(2)	**Citation**	**UR**	**PR**	**Gloss**
	ómuxaana	mu-xaana siina	muxaana sína	'Which girl? cl.1'
	kúmusaala	mu-saala siina	musaala sína	'Which tree? cl.3'
	kímirwe	mi-rwe siina	mirwe sína	'Which heads cl.4'
	kámaru	ma-ru siina	maru sína	'Which ears?cl.6'
	ɛɛnama	n-yama siina	ɲama sína	'Which meat? cl.9'[4]
	číŋgo	n-ko siina	ŋgo sína	'Which homes? cl.10'
(3)		u-xaana siina	*oxaana sína	'Which girl? cl.1'
		ki-rwe siina	*kirwe sína	'Which heads cl.4'
		ka-ru siina	*karu sína	'Which ears?cl.6'
		ɛ-yama siina	*ɛyama sína	'Which meat? cl.9'
		či-ko siina	*čiko sína	'Which homes? cl.10'

In contrast to (2), the preprefix appears without the prefix as a marker of agreement on verbs in certain syntactic constructions (cf.(4)). Moreover, just as preprefixes cannot replace the prefixes in (2) without yielding ill-formed structures, the unacceptable forms in (5) serve as confirmation that the prefix cannot be used in place of the preprefix in the other parts of the grammar.

(4)			
	ku-mu-saal-a ku-ku-a	kúmusaalá kukwa	'the tree falls cl.3'[5]
	ki-mi-saal-a ki-ku-a	kímisaalá kikwa	'the trees fall cl.4'
	ka-ma-ru ka-ku-a	kámarú kakwa	'the ears fall cl.6'
	e-n-yama e-ku-a	ɛɛɲaméekwa	'the meat falls cl.9'
	či-n-ko či-ku-a	číŋgó čikwa	'the homes fall cl.10'

[4] An underlying stem-initial glide deletes postnasally by regular Ganda Law, a pervasive rule which deletes a stem-initial postnasal consonant in case the following syllable has a nasal onset; apparently, this happens after homorganic nasal assimilation.

[5] Although it might be a leap of faith to assume that the preprefix marks agreement on verbs, the motivation is overwhelming, given that the agreement marker is identical to the preprefix in eighteen out of 19 classes, the only exception being cl.1 whose agreement marker is **a-**, not the preprefix **u-**. The burden of proof seems to fall on those who argue that the agreement marker in this case is not related to the preprefix.

(5)			
	ku-mu-saal-a mu-ku-a	kúmusaalá *mukwa	'the tree falls cl.3'
	ki-mi-saal-a mi-ku-a	kímisaalá *mikwa	'the trees fall cl.4'
	ka-ma-ru ma-ku-a	kámarú *makwa	'the ears fall cl.6'
	e-n-yama n-ku-a	éɛ́ŋamá *ŋgwa	'the meat falls cl.9'
	či-n-ko n-ku-a	číŋgó *ŋgwa	'the homes fall cl.10'

We get more evidence of prefix-preprefix autonomy from the "**Omweene**"-construction, which translates as "The owner of X", where "X" is a noun variable. As in the above cases, this structure (cf.(6)) shows that the noun is well-formed even when the preprefix is omitted. Data (7) are illustrative.

(6)	**UR**	**PR**	**Gloss**
	u-mu-ene mu-an-a	ómweene mwáana	'the owner of the child'
	u-mu-ene mu-saal-a	ómweene músaala	'the owner of the tree'
	u-mu-ene mi-xono	ómweene míxono	'the owner of the hands'
	u-mu-ene maru	ómweene máru	'the owner of the ears'
	u-mu-ene n-yam-a	ómweene ŋama	'the owner of the meat'
	u-mu-ene n-ko	ómweenéɛ́ŋgo	'the owner of the home'
(7)	u-mu-ene u-mu-an-a	*ómweene ómwaana	'the owner of the child'
	u-mu-ene ku-mu-saal-a	*ómweene kúmusaala	'the owner of the tree'
	u-mu-ene ki-mi-xono	*ómweene kímixono	'the owner of the hands'
	u-mu-ene ka-ma-ru	*ómweene kámaru	'the owner of the ears'
	u-mu-ene e-n-yam-a	*ómweene ɛɛŋama	'the owner of the meat'
	u-mu-ene e-n-ko	*ómweene éengo	'the owner of the home'

Since prefixes and preprefixes have different distributional properties in the grammar, it follows that treating them as separate but closely bound units is well-motivated.

1.1.2 CVCV Prefix Structures

As already observed, some CVCV prefix structures comprise two identical syllables; such structures exhibit two allomorphs. The first appears when no other phonological process (e.g., GF, VC, PNC, etc.) applies first to modify the prefix so that it is no longer identical to the preprefix, in which case the prefix deletes by haplology. We follow Hayes (1989) in assuming that it is the prefix (and not the preprefix) that deletes, as it would be harder to explain the simultaneous lengthening of the surviving vowel if we assumed instead that the preprefix deleted, since CL across onsets is rare.[6]

The second allomorph appears when a phonological process alters the prefix, and as a result, removes the strict prefix-preprefix identity that must prevail for haplology to apply. In such cases, both the altered prefix and the preprefix surface, as the prefix can no longer haplologize. Example (8), which has two sets of data, illustrates, first outputs of prefix haplology, (8a); and the failure of haplology after it is bled by earlier rules.

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[6] Hayes's claim that this follows from Goldsmith's (1976) constraint on crossing lines does not hold since the moraic (= prosodic) tier is separate from the segmental tier. Therefore the rarity of cases of CL across onsets cannot be attributed to the blocking effect of the line linking the onset to the syllable node.

(8)a.	P1	P2	Stem	PR	Gloss
	xu	xu	-lim-a	xuulima	'to cultivate (cl.15)'
	xa	xa	-ßako	xaaßako	'small hoe (cl.12)'
	ßa	ßa	-xasi	ßáaxasi	'women (cl.2)'
b.	xu	xu	-iɲa-a	xúxwiiɲa.a	'to play (cl.15)'
	xu	xu	-om-a	xúxwooma	'to dry (intr.)'
	ßa	ßa	-ifu-i	ßáßeefwi	'thieves (cl.2)'

We examine the phenomenon in (8a) in more detail in §3.4, while the various phonological rules shown modifying the prefix in (8b) are dealt with under GF (§3.1), VC (§3.2), and PNC (§3.3). We shall now look at the verb structure.

1.2 Verb Structure

In its simplest form, a Bukusu verb takes a subject prefix (cf.(9a)), followed by an optional tense marker (cf.(9b)), which may in turn be followed by an object prefix (cf.(9c)), culminating in the lexical verb. All the verbal prefixes either end in a vowel or nasal.

(9)a.	SP	Stem	PR	Gloss
	n	ßona	mbona	'I see'
	u	ßona	oßona	'You sg. see'
	a	ßona	aßona	'He sees'
	xu	ßona	xußona	'We see'
	mu	ßona	mußona	'You pl. see'
	ßa	ßona	ßaßona	'They (cl.2) see'

b.	SP	TM	Stem	PR	Gloss
	n	la	ßona	ndáßona	'I'll see'
	u	la	ßona	oláßona	'You sg. will see'
	a	la	ßona	aláßona	'He'll see'
	xu	la	ßona	xuláßona	'We'll see'
	mu	la	ßona	muláßona	'You pl. will see'
	ßa	la	ßona	ßaláßona	'They (cl.2) will see'

c.	SP	TM	OP	Stem	PR	Gloss
	n	la	mu	ßona	ndámußona	'I'll see him'
	u	la	mu	ßona	olámußon	'You sg. will see him'
	a	la	mu	ßona	alámußona	'He'll see him'
	xu	la	mu	ßona	xulámußona	'We'll see him'
	mu	la	mu	ßona	mulámußona	'You pl. will see him'
	ßa	la	mu	ßona	ßalámußona	'They (cl.2) will see him'

Thus the underlying structure of a Bukusu verb is summarized in (10), where SP is the subject prefix, TM is the tense marker, and OP stands for the object prefix. The parentheses around TM and OP indicate that these units are optional.

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[7] Given that the cl.1 subject agreement prefix is **a-** rather than **u-**, which we would expect if agreement was marked by preprefixes, it has been suggested that subject agreement markers constitute a separate set of prefixes from nominal preprefixes. However, when we consider that preprefixes and subject agreement markers are identical in eighteen out of ninteen classes, the similarity can hardly be considered accidental.

(10) *Bukusu Verb Structure*

SP + (TM) + (OP) + STEM.

The verb structure in (10) predicts that a high vowel of the SP, TM or OP will glide when affixed to a vowel-initial verb stem, as illustrated in (11a) below. But if the stem-initial vowel is non-high, vowel contraction applies, as in (11b). On the other hand, a prefix structure which ends in a nasal causes the SP vowel to lengthen when affixed to a C-initial stem, as illustrated by (11c). The trigger is the NC cluster created when affixation places the prefix nasal next to the following stem-initial consonant, in which case the lengthening results from regular PNC.

(11)a.	**SP**	**Stem**		**PR**	**Gloss**
	n	iča		níča	'I come'[8]
	u	iča		wíča	'you sg. come'
	xu	iča		xwíča	'we come'
	mu	iča		mwíča	'you pl. come'
b.	a	iča		ééča	'he comes'
	ßa	iča		ßééča	'they (cl.2) come'
	xa	iča		xééča	'you pl. will come'
c.	**SP**	**OP**	**Stem**	**PR**	**Gloss**
	u	n	čuxa	úúŋ̀juxa	'you sg. defeat me'
	ßa	n	čuxa	ßááŋ̀juxa	'they (cl.2) defeat me'
	mu	n	čuxa	múúŋ̀juxa	'you pl. defeat me'

The three processes exhibited in (11) will be examined further in §3.

2. Theoretical Background

Although both the CV and moraic theories postulate multiple tiers for phonological representations, they differ in their claims regarding the elements which characterize the prosodic tier, because where the CV theory postulates Cs and Vs for the timing tier, the moraic theory proposes the mora, adding that non-vocalic segments are generally non-moraic. Thus while in the CV framework (see structure (12)) the array of Cs and Vs constitute the skeleton (= prosodic tier), moras constitute the prosodic structure in the moraic theory, as in (13).

(12) *CV - Representation*

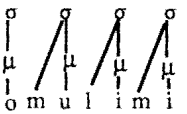
Syllable tier

CV-tier

Segmental tier

[8] As we shall show in §5, the 1 sg. SP, /n/, causes a following stem initial vowel to lengthen, indicating that the nasal prefix is underlyingly moraic.

(13) *Moraic Representation*



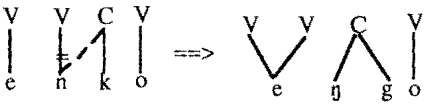
Syllable tier

Moraic (= prosodic) tier

Segmental tier

Thus both the CV and moraic theories postulate multiple tiers of phonological representation. This predicts that rules which target elements in one tier do not automatically affect other tiers, and that elements in one tier can be linked to multiple slots in another tier to yield Clements' (1986) "segmental analogues of Goldsmith's (1976) contour tones", as illustrated by the following derivation of **/e-n-ko/** ---> **[éeŋgo]** 'at home'.

(14)



However, the two theories differ in their claims about prosodic structure. We show in §4 that only moraic theory is equipped to deal with the two types of syllable deleting processes found in Bukusu. First, we turn to the three most common causes of CL.

3.0 **Long Vowels in Bukusu**

As the presence of derived long vowels imply existence of underlying long vowels in a language, we cite (15a,b) to show that vowel length is distinctive in Bukusu.

(15)a.	xúu-roora	'to dream'	b.	xúu-rora	'to pluck'
	xúu-xaasa	'to spit'		xúu-xasya	'to heat up'
	xuu-kuula	'to roof'		xuu-kula	'to buy'
	xuu-siima	'to thank'		xúu-sima	'to burn out (e.g., fire)
	xúu-tiima	'to get lost'		xuu-tima	'to run'
	xúu-seesa	'to winnow'		xuu-sela	'to boil'
	xuu-teena	'to dry up'		xuu-teßa	'to seat

Four phonological processes generate derived long vowels via CL. First, a vowel lengthens when the first of two adjacent vowels becomes a glide,[9] as illustrated in (16).

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[9] Apparently, underlying glides do not trigger lengthening of following short vowels, as shown below. ((a) contains infinitives while (b) contains diminutivized nouns):

a.	xu + xu + yokela	xuuyokela	'to make noise'
	xu + xu + yama	xuuyama	'to scout for s.t.'
b.	xa + xa + yama	xaayama	'small piece of meat'
	xa + xa + yila	xaayila	'small road'

The case of underlying /w/ is dealt with later, it deletes obligatorily at the surface, except in the monosyllabic stems **-w-a** 'give' and **-wa** 'thorn' .

(16)	SP	V-stem	PR	Gloss
	mu	-iča	mwííča	'you (pl) come'[10]
	lu	-ißa	lwiißa	'it (cl.11) steals'
	ßi	-asama	ßyaasáma	'they (cl.8) open mouths'
	li	-ola	lyóóla	'it (cl.5) arrives'

Secondly, a stem-initial vowel which is preceded by a non-high prefix vowel undergoes lengthening following the deletion of the preceding prefix vowel, as shown in (17). We refer to this change as vowel contraction (VC); see §3.2 for further discussion.[11]

(17)	P_1	P_2	N-Stem	PR	Gloss
	ka	ma	-ino	kámeeno	'teeth cl.5'
	ka	ma	-olu	kámoolu	'nose cl.5'
	ßa	ßa	-an-a	ßáßaana	'children cl.2'
	ßa	ßa	-ifu-i	ßáßeefwi	'thieves cl.2'
	ßa	ßa	-oni	ßáßooni	'sinners cl.2'

The third type of lengthening applies before nasal-consonant (NC) sequences. This process, which we refer to as PNC, is obligatory in Bukusu. Consider (18) for instance. Notice particularly the length difference between the vowels of the subject prefixes in (18a), and the same subject prefixes in the pre-NC positions in (18b). (Underlying stem-initial /w/ hardens to [b] postnasally.)

(18)a.	SP	OP	V-Stem	PR	Gloss
	ßa	xu	-wa	ßaxúwa	'they give you (sg.)'
	ßa	mu	-wa	ßamúwa	'they give him'
	xu	ßa	-wa	xußáwa	'we give them'
	xu	xu	-wa	xuxúwa	'we give you (sg.)'
	ßa	ßa	-wa	ßaßáwa	'they give them'

b.	SP	OP	V-Stem	PR	Gloss
	ßa	n	-wa	ßáámba	'they give me'
	mu	n	-wa	múúmba	'you (sg.) give me'
	a	n	-wa	áámba	'he gives me'
	u	n	-wa	úúmba	'you sg.give me'

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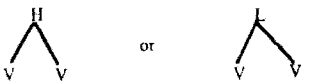
[10] We know that the stem-initial vowel is underlyingly short because of the evidence from a rule that maps H tones as follows: (i) place H on the first stem mora of a low-toned verb when the SP is affixed; and (ii) place H on the second stem mora in case the verb is high-toned, as long as the second mora is not also the final vowel. This means that if the stem-initial vowel in [mwííča] 'you pl. come' had been long underlyingly, it would have surfaced with a falling tone since [xuxwiiča] 'to come' is long-toned. Conversely, [lwiißa] 'it cl.11 steals' should have had a rising tone on the first syllable since [xúxwiißa] 'to steal' is high-toned. The fact that both forms surface with level tones on the initial vowel confirms that these vowels were short underlyingly, but lengthened as a result of glide formation, in which case the resultant long vowels have a doubly linked tone, as depicted below:



[11] This phenomenon is treated as vowel coalescence in traditional accounts, but evidence from (17) and other examples suggests that besides the feature [-hi], which spreads from the deleting vowel, all the other properties of the lengthened vowel belong to the surviving vowel, which suggests that the process is more a deletion than coalescence. This also indicates that height spreading precedes vowel contraction. (cf. fn. 16 & 17.)

Although both the CV and moraic theories handle CL from GF, VC, and PNC satisfactorily, Bukusu also has a process which deletes a prefix after an identical preprefix, thereby causing the vowel of the surviving pre-prefix to lengthen. Apparently, this prefix haplology applies only when there is complete identity between the prefix and the preprefix. Thus if a prefix altering rule applies before haplology, it will bleed the latter. For instance, (19a) exhibit lengthened preprefix vowels attributable to CL after prefix haplology, while haplology fails in (19b) because an earlier rule has removed prefix-preprefix identity.

(19)a.	**P_1**	**P_2**	**Stem**	**PR**	**Gloss**
	xu	xu	-lima	xuulima	'to cultivate (cl.15)'
	ßa	ßa	-xasi	ßáaxasi	'women (cl.2)'
	ßi	ßi	-tußi	ßiitußi	'small baskets (cl.8)'
	li	li	-kulu	liikulu	'sky (cl.5)'
	lu	lu	-kuulo	luukuulo	'rafter (cl.11)'
	ku	ku	-nwa	kuunwa	'big mouth (cl.20)'
b.	xu	xu	-ißa	xúxwiißa	'to steal (cl.15)'
	ßa	ßa	-oni	ßáßooni	'sinners (cl.2)'
	ßi	ßi	-ndu	ßißiindu	'things (cl.8)'
	li	li	-ino	líliino	'tooth (cl.5)'
	lu	lu	-ala	lúlwaala	'finger (cl.11)'
	ku	ku	-uya	kúkuuya	'draft of air (cl.20)'

We discuss further the forms in (19a) in §3.4, where we argue that CL from prefix haplology is predictable, given the mora conservation principle (cf. Hayes 1989:285).

3.1 Glide Formation

We already saw in (17) that Bukusu high vowels become glides before other vowels. GF is a pervasive process in Bukusu which applies to subject and object prefixes within verb structure, lexical noun and adjectival prefixes, and stem-internal high vowels. (20)-(22) should suffice in this respect. Here we see that GF fails in the (a) examples before consonant-initial stems, but applies before the vowel-initial stems in (b).

(20) **Verbs**

	SP	**V-Stem**	**PR**	**Gloss**	
a.	i	-tima	etíma	'it runs'	(cl.9)
	xu	-lya	xulya	'we eat'	
	ku	-čexa	kučéxa	'it laughs'	(cl.3)
	ßi	-suta	ßisúta	'they carry '	(cl.8)
	u	-teexa	oteéxa	'you (sg) cook'	
b.	i	-ola	yóóla	'it arrives'	
	xu	-iča	xwííča	'we come'	
	ku	-ara	kwáára	'it (cl.3) splits'	
	ßi	-eŋa	ßyééŋa	'they (cl.8) want'	
	u	-akama	waakáma	'you cease'	

(21) **Nouns**

	P_1	P_2	N-Stem	PR	Gloss[12]
a.	u	mu	-xaana	ómuxaana	'girl' (cl.1)
	ku	mu	-saala	kúmusaala	'tree' (cl.3)
	li	li	-koxe	liikoxe	'ash' (cl.5)
	ßi	ßi	-yeywe	ßiiyeywe	'brooms'(cl.8)
	li	li	-wa	líiwa	'thorn'(cl.5)
b.	u	mu	-ana	ómwaana	'child' (cl.1)
	ku	mu	-ißa	kúmwiißa	'sugarcane'(cl.3)
	li	li	-olu	lílyoolu	'nose' (cl.5)
	ßi	ßi	-uma	ßíßyuuma	'beads'(cl.8)
	ki	mi	-asi	kímyaasi	'shins'(cl.4)

(22) **Adjectives**

	P_1	P_2	A-Stem	PR	Gloss
a.	o	mu	-layi	ómulayi	'good'(cl.1)
	ku	mu	-ßisi	kúmußisi	'raw' (cl.3)
	li	li	-nefu	líinefu	'fat' (cl.5)
	ßi	ßi	-xulu	ßíixulu	'elderly' (cl.8)
b.	o	mu	-imbi	ómwiimbi	'short'(cl.1)
	ku	mu	-ana	kúmwaana	'young'(cl.3)
	li	li	-asa	ílyaasa	'gap' (cl.5)
	ßi	ßi	-omu	ßíßyoomu	'dry' (cl.8)

In SPE type phonology, GF is formalizable as (23). We return to this process later.

(23) *Glide Formation*:[13]

$$\underset{[+hi]}{V} \quad \text{---}> \quad G \quad / \_\_\_\_\_ \; V$$

3.2 Vowel Contraction

This section examines the rule that deletes a vowel (VC) in certain contexts. Two types of data are used for this purpose: where VC is a lexical process, and where it is postlexical.

3.2.1 VC at the Word-Level

Briefly, a non-high prefix vowel deletes before a vowel-initial stem, as summarized in (24).

(24) *Vowel Contraction*

$$\underset{[-hi]}{V} \text{ -----}> \emptyset \quad / \quad \_\_\_\_\_ \; V$$

---

[12] Note here that stems starting with underlying glides (i.e., the last two examples of (21a)) behave like C-initial stems. We invoke this feature later on to argue for an abstract stem-initial consonant in apparent exceptions.

[13] The rule is written in very general terms because there is no indication that it does not affect high vowels preceding other high vowels. In fact, a form like /u+ič-a/ ---> [wíča] 'you come' shows that high vowels glide before other high vowels. Therefore to account for alternations like /i+ix-a/ ---> [íixa] ~ [yíixa] 'it (cl.9) descends', we propose optional glide deletion which applies to a glide before a corresponding high vowel.

Whether (24) captures vowel contraction correctly is determined by the effects of both C- and V-initial stems on the prefix vowel. In general, the prefix vowel remains short before intial C, as in (25a), and lengthens before initial V in (25b).

	P_1	P_2	Stem	PR	Gloss
(25)a.	ka	ma	-loßa	kamaloßa	'land' (cl.6)
	ka	ma	-ru	kámaru	'ears' (cl.6)
	ka	ma	-ßi	kámaßi	'bad ones' (cl.6)
b.	ßa	ßa	-oni	ßáßooni	'sinners'
	ßa	ßa	-ene	ßáßeene	'same ones' (cl.2)
	ka	ma	-omu	kámoomu	'dry ones' (cl.6)
	xa	xa	-umu	xáxuumu	'little sunshine' (cl.12)

Further evidence of VC comes from verbs, where prefix vowels remain unchanged before consonant-initial stems (see (26a)), but delete before vowel-initial stems, as in (26b).

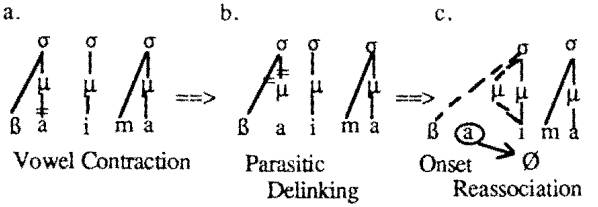
(26)a.	ßa	-ča	ßača	'they (cl.2) go'
	xa	-lya	xalya	'it (cl.12) eats'
	ka	-fwa	kafwa	'they (cl.6) die'
b.	ßa	-iča	ßeéča	'they (cl.2) come'
	xa	-ißa	xeeßa	'it (cl.12) steals'
	ka	-ola	koóla	'they (cl.6) arrive'

Since non-linear phonology accounts for VC by postulating the deletion of association lines linking a vocalic segment to a slot in the prosodic tier, the change from underlying **/ßa-ima/** to surface **[ßeema]** 'they stand' can be assigned the two respective CV and moraic representations in (27) and (28).

(27) *Vowel Contraction CV version*

[Stray Erasure, Steriade 1982]

(28) *Vowel Contraction Moraic Version:*



In the moraic account, the prefix vowel first deletes by rule (24). This creates a syllable node without a nucleus, which undergoes Parasitic Delinking (see (65) below), a rule which deletes a syllable that does not dominate a nucleus. During the subsequent resyllabification, the now unassociated C and mora reattach to the next available syllable, as in (28c).

Apparently, a rule spreading the [hi] value of the first vowel to the second is ordered to apply before VC; see fn.16.

3.2.2 **Post-lexical VC**

Vowel contraction applies across word-boundaries as well. All that the rule requires is a sequence of vowels with the first being non-high. For instance, the final vowel of a noun or adjective will delete before the initial vowel of the following verb, as in (29) and (30).

(29)a. **Verbs**

Imperative	**SP**	**V-Stem**	**PR**	**Gloss**
kwa!	i	-ku-a	ekwa	'it (cl.9) falls'
tima!	a	-tim-a	atíma	'he runs'
lila!	u	-lil-a	olíla	'you (sg.) cry'
lwaála	a	-lwaal-a	alwaála	's/he ails'

b.

noun	**verb**	**PR**	**Gloss**
éengoxo	ekwa	éengoxéekwa	'the chicken falls'
omwaana	atíma	ómwaanáatíma	'the dog runs'
wámweene	olíla	wámweenoolíla	'you yourself cry'
omukooko	alwáála	ómúkóókáalwáála	'the daughter ails'
éengurwe	exalála	éengurwéexalála	'the pig gets annoyed'

(30)

Adjective	**Verb**	**PR**	**Gloss**
eembolo	ekwa	éembóléekwa	'the rotten (cl.9) falls'
éeŋana	ekwa	éeŋanéekwa	'the young (cl.9) falls'
éexulu	ekwa	éexulíikwa	'the elderly (cl.9) falls'

The changes in (29) and (30) can be summarized as (31a,b) respectively.

(31)a.

o + e	--->	ee[14]	
a + e	--->	ee	
e + o	--->	oo	
o + a	--->	aa	
e + e	--->	ee	

b.

o + e	--->	ee
e + e	--->	ee
a + e	--->	ee
u + e	--->	ii[15]

Thus VC is both a lexical and a post-lexical rule in Bukusu.

The 1st case of VC that we examine appears in the relative construction, which in Bukusu is formed by when a relative pronoun attaches to the verb. Like the infinitive prefix, the relative prefix comprises two identical syllables, which in turn are identical to the subject

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[14] Since vowel lowering is a lexical rule, we assume that the verb-initial vowel that triggers VC has already lowered. Therefore the last example in (31b) is the only puzzling outcome, since the high vowel not only fails to trigger GF, but also triggers raising in the surviving vowel. (Also see (32c)). A possible explanation is that high vowels glide and then delete by rule, which seems to be supported by the following examples:

eɲjuxi ekwa	---> éeɲjuxíikwa	'the bee falls'
omuxasi akwa	---> ómuxasyáakwa	'the woman falls'
omuundu oyo	---> ómuundúuyo	'that person'
omuundu akwa	---> ómúúndwáakwa	'the person falls'

The problem that remains unresolved is why the verb-initial vowel revert [+hi] in the first and third cases.

[15] If we assume that the [+hi] value of /u/ first spreads to convert the following mid vowel to [+hi], we can then posit GF by rule (23) prior to (optional) glide deletion, given that **[éexuiwíikwa]** is an acceptable variant of the last example in (30).

prefix of the preceding (subject) noun or adjective. Thus the verb stem takes a relative prefix consisting of two identical vowels in case it is preceded by a class 1 or 9 subject, as in (32b). When this derived sequence of verb-initial vowels combines with the final vowel of the preceding subject, the output is an underlying sequence of three vowels, as in (32c). However, only two moras surface, presumably due to a mora trimming rule (Clements 1986:57) that limits the optimal syllable length to two moras. (RP = relative prefix.)

(32)a.	**SP**	**V-Stem**	**PR**	**Gloss**
	i	-li-a	elya	'it (cl.9) eats'
	a	-li-a	alya	's/he eats'
	i	-xol-a	exola	'it (cl.9) does'
	a	-č-a	ača	's/he goes'

b.	**RP_1**	**RP_2**	**V-Stem**	**PR**	**Gloss**
	i	i	-li-a	éelya	'which eats'
	u	u	-li-a	óolya	'who eats'
	u	u	-naany-a	óonaánya	'who bothers'
	u	u	-č-a	óoča	'who goes'

c.	**Noun**	**Verb**	**PR**	**Gloss**
	éxaafu	éelya	éxaafúlya	'the cow which eats'
	éeŋgoxo	éelya	éeŋgoxéelya	'the chicken which eats'
	omuundu	ooxola	ómuundúuxola	'the person who does'
	ómwaana	oonaánya	ómwaanóonaánya	'the child who bothers'
	ómuxasi	oča	ómuxasúuča	'the woman who goes'

At least three observations can be made about (32): (i) VC is both lexical and postlexical; (ii) VC applies to any non-high vowel preceding another vowel; and (iii) the height of the deleting vowel determines the height of the surviving vowel.[16]

3.3 **Prenasal-Consonant Lengthening (PNC)**

As we saw in §3.0, PNC applies obligatorily to vowels preceding nasal-consonant sequences. Data (33) confirm this fact, because (33a) has verbs containing only a subject prefix (SP) and a stem. The length contrast between the short SP vowels in (33a) and their counterparts in (33b) is confirmation that the longer prefix vowels in (33b) is caused by the 1sg. object prefix (OP) nasal which was not present in (33a).

(33)a.	**Infinitive**	**SP**	**V-Stem**	**PR**	**Gloss**
	xúura	u-	-ra	ora	'you (sg) put'
	xuupiima	a-	-piima	apíima	's/he weighs (tr.)'
	xúulasa	i-	-lasa	elasa	'it (cl.9) shoots'
	xúuteexa	mu-	-teexa	muteéxa	'you (pl.) cook'
	xúußukula	ßa-	-ßukula	ßaßukúla	'they (cl.2)take'
	xuučexa	ku-	-čexa	kučéxa	'it (cl.3) laughs'

[16] As mentioned earlier, one could argue that first the height value of the first vowel spreads to the second vowel. This is followed by GF, then glide deletion; the last example in (32c) is especially important in this regard, and given fn.15.

b.	SP	OP	V-Stem	PR	Gloss
	u	n	-ɾa	úúnda	'you (sg.) put me'[17]
	a	n	-piima	áámbiima	's/he weighs me'
	i	n	-lasa	ííndasa	'it (cl.9) shoots me'
	mu	n	-teexa	múúndééxa	'you (pl.) cook me'
	ß	n	-ßukula	ßáámbukúla	'they (pl.) take me'
	ku	n	-čexa	kúúɲjexa	'it (cl.3) laughs at me'

We also note that in the absence of the OP nasal, a word-initial short high vowel lowers to mid, as in the first example in (33a). This rule is blocked when the OP nasal causes the prefix vowel to lengthen, as in (33b).

Another case of PNC is exhibited by the class 9/10 prefixes, which consist of a nasal prefix preceded by a preprefix vowel. Since a NC sequence is created whenever these attach to a consonant-initial stem, our prediction is that the preprefix vowel will undergo lengthening, and that precisely is what we find in the following cl.9/10 forms.

(34)a.	P_1	P_2	N-Stem	PR	Gloss
	e	n	-tuuyu	ééndúuyu	'a rabbit'
	e	n	-kußo	eeŋgußo	'clothe'
	e	n	-yuxi	éeɲjuxi	'a bee'
	e	n	-yofu	eeɲjofu	'elephant'
	e	n	-ßako	eembako	'hoe'
	e	n	-paaŋga	éembaáŋga	'large pot'
b.	či	n	-tuuyu	čííndúuyu	'rabbits'
	či	n	-kußo	čiiŋgußo	'clothes'
	či	n	-yuxi	číiɲjuxi	'bees'
	či	n	-ßako	čiimbako	'hoes'
	či	n	-paaŋga	čiimbaáŋga	'large pots'

But how do we know that the preprefix vowel in (34) is not underlyingly long? The crucial evidence comes from the following sets of nouns, which have no underlying nasal prefixes, although they act like cl.9/10 nouns, and therefore surface with short prefix vowels. Therefore their length in (34) must be caused by CL.

(35)a	P_1	P_2	N-Stem	PR	Gloss
	e	-	-tiimu	étiimu	'a team cl.9'
	e	-	-kalaamu	ékaláamu	'a pen cl.9'
	e	-	-ßarwa	éßarwâ	'a letter cl.9'
	e	-	-taraača	étaráača	'a bridge cl.9'
	e	-	-faraasi	éfaráasi	'a horse cl.9'
	e	-	-čoo.o	éčoo.ô	'a toilet cl.9'
	e	-	-sa.aani	ésa.áani	'a plate cl.9'
	e	-	-moosi	emoosi	'a calf cl.9'
	e	-	-maali	émáali	'wealth cl.9'

[17] Two processes apply simultaneously here: homorganic nasal assimilation (HNA), which applies vacuously before alveolar consonants, and the change of the liquid into a stop.

b. P_1	P_2	N-Stem	PR	Gloss
či	-	-tiimu	čítíimu	'teams cl.10'
či	-	-kalaamu	číkaláamu	'pens cl.10'
či	-	-ßarwa	číßarwâ	'letters cl.10'
či	-	-taraača	čítaráača	'bridges cl.10'
či	-	-tiika	čítíika	'giraffes cl.10'
či	-	-faraasi	čífaráasi	'horses cl.10'
či	-	-čoo.o	číčoo.ô	'toilets cl.10'
či	-	-sa.aani	čísa.áani	'plates cl.10'

There are two reasons why (35) is not just a case of nasal deletion. First, it is unlikely that the nasal only deletes before all the consonants in (35), but not those in (34). Secondly, since (36) show nasal deletion before fricatives as a regular process, we would expect a lengthened prefix vowel if (35) involved nasal deletion. The conclusion then is that there is no underlying nasal prefix in the words in (35).

(36)a. P_1	P_2	N-Stem	PR	Gloss
e	n	-swa	éeswa	'termite'
e	n	-xisi	éexisi	'antelope'
e	n	-fula	éefula	'rain'
e	n	-xaßi	eexaßi	'luck'
e	n	-susi	éesusi	'bedbug'
e	n	-xolo	éexolo	'ethnic group'

b. P_1	P_2	N-Stem	PR	Gloss
či	n	-swa	číiswa	'termite'
či	n	-xisi	číixisi	'antelope'
či	n	-fula	číifula	'rain'
či	n	-xaßi	čiixaßi	'luck'
či	n	-susi	číisusi	'bedbug'
či	n	-xolo	číixolo	'ethnic group'

The third case of PNC that we shall consider occurs stem-internally before NC sequences that do not derive from some morphological process. As PNC is obligatory before all NC sequences, we expect stem-internal NCs to act similarly. (37) confirms this.

(37)a. **Nouns**

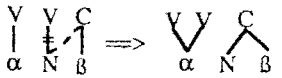
P_1	P_2	N-Stem	PR	Gloss
ku	mu	-kooŋgo	kúmúkóoŋgo	a back (cl.3)
ki	mi	-siiŋgi	kúmúsíiŋgi	a foundation (cl.4)
li	li	-ßoondo	liißoondo	a blister (cl.5)
e	n	-xooŋgo	eexooŋgo	a leader (cl.9)
lu	lu	-kooŋgo	luukooŋgo	a region (cl.11)
si	si	-piindi	síípíindi	a period (cl.8)

b. **Verbs**

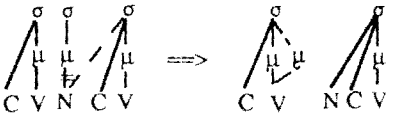
SP	V-Stem	PR	Gloss
a	-loonda	alóonda	'he follows'
ßa	-paaŋga	ßapaáŋga	'they arrange'
n	-iinda	ndíinda	'I wait'
xu	-suuŋga	xusuúŋga	'we hang'
u	-fuuŋ̌ja	ofuúŋ̌ja	'you (sg) break down (tr.)'
mu	-xeeŋga	muxéeŋga	'you (pl.) sharpen'

Using the CV framework, Clements (1986) treats PNC as desyllabification of the nasal before a C. This involves nasal delinking from a dominating V-slot in the CV tier, plus a subsequent reassociation to the following C-slot, which already dominates a consonant. In this account, the output is a complex segment. Another effect of the desyllabification is that a "floating" V-slot is created that later relinks to the preceding vowel, as shown below. (Apparently, this V-slot deletes by Stray Erasure in case there is no preceding vowel.)

(38) *PNC - CV Account:*



(39) *PNC - Moraic Account:*[18]



Thus PNC can be captured in CV terms, as in (38), and in moraic terms, as in (39). However, even though accounts involve the delinking of association lines joining melodic units to prosodic slots, they differ in their claims about the new locus for the resyllabified nasal. More specifically, while nasal resyllabification creates a "complex segment" in the CV account, the output is not necessarily a complex segment in the moraic account, since both the nasal and the following C project directly to the syllable. Thus the moraic theory avoids positing the controversial complex segment.[19]

3.4 Syllable Deleting Processes

There are two processes that delete an entire syllable in Bukusu to create desirable surface forms. The first of these is an optional process that applies to the first syllable of the verb **-xupa** 'hit' under the conditions spelled out in §3.4.1. The second process affects more than half of the class prefixes of the upward of eighteen noun classes in Bukusu, and is discussed in §3.4.2.

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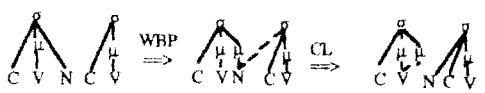
[18] There is a second way to do this in moraic theory, namely, we could assume that the nasal is not syllabic, but rather a regular coda consonant which undergoes weight by position prior to resyllabifying to give CL, as in the following derivation:



[19] One independent motivation for treating NCs as complex segments is the fact that Bukusu does not have any other cases of CC, except where the second C is a glide. However, given that Clements also treats consonant-glide combinations as sequences of segments which share the same prosodic slot in the CV tier, there would be no principled reason why consonant-glide sequences should not be considered complex segments. We shall leave the matter as it stands, pending further evidence to that effect.

3.4.1 The Verb *-xupa*

Although **-xupa** 'hit' is underlyingly a disyllabic stem, its surface forms show that the first stem syllable deletes optionally after a short prefix vowel.[20] To illustrate this, we shall consider four sets of data, three of which exhibit first syllable deletion (henceforth **xu-deletion**). The fourth set has been added to show that long vowels block this process.

First, as illustrated in (40), **xu-** deletes after a short subject prefix (SP) vowel to trigger compensatory lengthening in the subject prefix vowel. From the surface alternations, it is also apparent that the subject prefix vowel remains short if **xu** does not delete. The lengthening of one vowel after deletion of another is not unusual in autosegmental phonology, as segment deletion does not entail an automatic reduction of timing positions.

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[20] This syllable deletion is an unique property of **-xupa**, since no other C-initial stem undergoes the rule. For instance, the initial syllables always surface in the following stems:

SP	V-Stem	PR	Gloss
n	-kula	ŋgúla	'I buy'
n	-xula	xula	'I grow (intr)'
u	-kula	okúla	'you buy'
u	-xula	oxula	'you grow (intr.)'
xu	-kula	xukúla	'we buy'
xu	-xula	xuxula	'we grow (intr.)'

In view of these, Hyman (p.c.) has suggested that we treat **-xupa** 'hit' as having the underlying form, **-Vpa**, where V is an underspecified vowel. But there are two arguments against this representation. First, the imperative for this stem is consonant-initial, which means that even if we posited an underspecified initial syllable vowel, we would still have to explain the loss of the initial consonant, and why only this consonant deletes, given that no other consonant-initial stem loses its initial consonant in a similar manner. The second argument is that postulating the structure **-Vpa** makes the wrong predictions about the surface forms of structures like the following where the 1 sg. OP is affixed between the SP and the stem:

OP	SP	Stem	Predicted	PR	Gloss
u-	n-	-Vpa	*únipa	úúxupa	'you sg. hit me'
mu-	n-	-Vpa	*múnipa	múúxupa	'you pl. hit me'
βa-	n-	-Vpa	*βánipa	βááxupa	'they hit me'
a-	n-	-Vpa	*ánipa	ááxupa	's/he'll hit me'
ni-	n-	-Vpa	*ninipa	niixupa	'I hit myself'

In short, the above examples confirm that the stem for 'hit' is **-xupa**.

(40)	**Imperative**	**SP**	**V-Stem**	**PR**	**Gloss**
	xupa!	u	-xupa	uupa ~oxupa	'you sg. hit'
		a	-xupa	aapa ~axupa	'he hits'
		xu	-xupa	xuupa ~xuxupa	'we hit'
		mu	-xupa	muupa ~muxupa	'you (pl.) hit'
		ßa	-xupa	ßaapa ~ßaxupa	'they hit'
		n	-xupa	niipa ~xupa	'I hit'[21]

The second set of examples exhibit similar prosodic properties as the first, the only difference being the triggering vowel, which, as in (41), is the object prefix (OP).

(41)	**SP**	**OP**	**V-Stem**	**PR**	**Gloss**
	n	ßa	-xupa	mbáapa mbáxupa	I hit them
	u	ßa	-xupa	oßáapa oßáxupa	you sg. hit them
	a	ßa	-xupa	aßáapa aßáxupa	's/he hits them
	xu	ßa	-xupa	xußáapa xußáxupa	'we hit them'
	mu	ßa	-xupa	mußáapa mußáapa	'you (pl) hit them'
	ßa	ßa	-xupa	ßaßáapa ßaßáxupa	'they hit them'

The final motivation for **xu-deletion** derives from the behavior of -**xupa** when the infinitive prefix is attached. Consider (42).

(42)	P_1	P_2	**-Stem**	**PR**	**Gloss**
	xu	xu	-xupa	xúxuupa xúuxupa *xuxuxupa[22]	'to hit'

The surface alternations suggest that when faced with the choice between **xu-deletion** and **prefix haplology**, the speaker applies either of the two rules, the output of either rule being well-formed in the language. If the speaker applies **prefix haplology**, the preprefix

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[21] The 1 sg. nasal prefix is underlyingly moraic, therefore a potential trigger for -**xu** deletion just like a short vowel, in which case it should become a geminate or syllabic nasal. But since Bukusu has no surface syllabic nasals, [i] epenthesis occurs in the formation of **niipa** 'I hit' to resolve the problem created by **xu**-deletion, as something has to lengthen compensatorily. The variant form shows the nasal as having deleted before the stem-initial fricative (cf. (36)). Apparently, most speakers delete **xu**-, although the variant forms are quite common since many speakers apply **xu-deletion** optionally.

[22] This forms should not be confused with the structure **xuxúxupa**, a variant of **xuxúupa** 'We hit you', where the first **xu** marks 1 pl. subject, the second marks 2 sg. object, and the third is the first stem syllable. Since this latter form is well-formed, it might not be premature to assume that only certain types of prefixes are subject to haplology and first syllable deletion. Further discussion follows in §3.4.2.

vowel lengthens and bleeds **xu-deletion**, since this latter rule requires a short triggering vowel. Conversely, haplology does not apply after **xu-deletion** because prefix-preprefix identity is removed by the lengthening prefix vowel.

That **xu-deletion** never occurs after long vowels gets support from the data in (43), where **xu-deletion** is blocked once the prefix vowel has lengthened by PNC. Thus unlike (40) and (41) which exhibit surface alternations, each example in (43) has only one surface form because PNC has bled **xu-deletion**.

(43)	**SP**	**OP**	**V-Stem**	**PR**	**Gloss**
	a	n	-xupa	ááxupa	's/he hits me'
	u	n	-xupa	úúxupa	'you sg. hit me'
	mu	n	-xupa	múúxupa	'you pl. hit me'
	ßa	n	-xupa	ßááxupa	'they hit me'
	ku	n	-xupa	kúúxupa	'it cl.3 hits me'

To recapitulate, Bukusu has a rule of optional **xu-deletion** that applies to the first syllable of -**xupa** 'hit' after a short prefix vowel. This predicts that a process which lengthens prefix vowels would bleed **xu-deletion**. We shall keep this process in mind as we now turn to haplology, the second process that deletes syllables.

3.4.2 **Prefix Haplology**

Data (19), which we repeat as (44) for ease of reference, showed that certain Bukusu prefixes delete after identical preprefixes (cf.(44a); also compare (45) with (46)). Besides, it was observed that vowel changing processes can bleed haplology by removing prefix-preprefix identity, which includes prosodic structure identity, and is determined after the application of rules like GF, VC, and so on.

(44)a.	**P_1**	**P_2**	**Stem**	**PR**	**Gloss**
	xu	xu	-lima	xuulima	to cultivate
	ßa	ßa	-xasi	ßáaxasi	women
	ßi	ßi	-tußi	ßiitußi	small baskets
	li	li	-kulu	liikulu	sky
	lu	lu	-kuulo	luukuulo	rafter
	ku	ku	-nwa	kuunwa	big mouth
b.	xu	xu	-ißa	xúxwiißa	to steal
	lu	lu	-ala	lúlwaala	finger
	ßa	ßa	-oni	ßáßooni	sinners
	li	li	-ino	líliino	tooth
	ku	ku	-uya	kúkuuya	draft of air
	ßi	ßi	-ndu	ßißiindu	things

We note from (45) and (46) that three fairly common Bantu processes - GF, VC, and PNC - bleed haplology in case they apply first. GF and PNC account for the changes in the prefix in (45), while GF and VC yield the surface forms of (46). If, however, haplology is not bled, the prefix structures in (45) and (46) surface respectively as (47) and (48).

(45) **Nouns**

P_1	P_2	N-Stem	PR	Gloss	
ßa	ßa	-ndu	ßaßaandu	'persons (cl.2)'	- PNC
ßu	ßu	-oßa	ßußwooßa	'mushroom (cl.14)'	- GF
li	li	-anda	lilyaanda	'charcoal (cl.5)'	- GF
si	si	-ndu	sisiindu	'thing (cl.7)'	- PNC
xa	xa	-ndu	xaxaandu	'thing (cl.12)'	- PNC
xu	xu	-iča	xuxwiiča	'to come (cl.15)'	- GF

(46) **Adjectives**

P_1	P_2	ADJ-Stem	PR	Gloss	
ßa	ßa	oki	ßáßooki	'sharp (cl.2)'	- VC
ßu	ßu	oki	ßúßwooki	'sharp (cl.14)'	- GF
ku	ku	oki	kúkwuuki	'sharp (cl.20)'	- GF
li	li	oki	lílyooki	'sharp (cl.5)'	- GF
mu	mu	oki	múmwooki	'sharp (cl.18)'	- GF
si	si	oki	sísyooki	'sharp (cl.7)'	- GF
xa	xa	oki	xáxooki	'sharp (cl.12)'	- VC
xu	xu	oki	xúxwooki	'sharp (cl.17)'	- GF

(47) **Nouns**

P_1	P_2	N-Stem	PR	Gloss
ßa	ßa	-xasi	ßáaxasi	'women (cl.2)'
ßi	ßi	-taßu	ßítaßu	'books (cl.8)'
ßu	ßu	-suma	ßúusuma	'cornbread (cl.14)'
ku	ku	-nani	kúunani	'ogre (cl.19)
li	li	-rofu	líirofu	'ripe banana (cl.5)'
lu	lu	-xu	lúuxu	'firewood (cl.11)'
si	si	-ßala	síißala	'the world (cl.7)'
xa	xa	-muka	xáamuka	'gourd (cl.12)'
xu	xu	-čuxa	xuučuxa	'to pour (cl.15)'

(48) **Adjectives**

P_1	P_2	ADJ-Stem	PR	Gloss
a	a	-layi	áalayi	'good (cl.16)
ßa	ßa	-rafu	ßáarafu	'hostile (cl.2)'
ßi	ßi	-xulu	ßíixulu	'old (cl.8)'
ßu	ßu	-čou	ßúučou	'big (cl.14)'
ku	ku	-kwaalaafu	kúukwaalaafu	'clear liquid (cl.20)'
li	li	-líiwaaŋga	líiwaaŋga	'rough (cl.5)'
lu	lu	-lulu	lúululu	'bitter (cl.11)'
mu	mu	-ŋifu	múuŋifu	'cold (cl.18)'
si	si	-ŋau	síiŋau	'thin (cl.7)'
xa	xa	-raandaafu	xáaraandaafu	'brown (cl.12)'
xu	xu	-ßalaayi	xúußaláayi	'wide (cl.17)'

Given that haplology applies to a prefix in case it is identical to the preceding preprefix, it is pertinent to investigate the other prefix structures targeted by this rule.

3.4.2.1 Other Prefixes which Haplologize

Besides the noun and adjective prefixes in (44)-(48), which haplologize after identical preprefixes, other targets of haplology include the infinitive of 'hit', which when contrasted

with **xuxúxupa** 'we hit you' (see fn.24), and the examples in (49) and (50)), reveals that given a sequence of identical syllables, prefix haplology will target the prefix.

(49)	**P_1**	**P_2**	**V-Stem**	**PR**	**Gloss**
	xu	xu	-xupa	xúxuupa ~xúuxupa	'to hit'

(50)	**SP**	**OP**	**V-Stem**	**PR**	**Gloss**
	xu	xu	-xupa	xuxúxupa ~xuxúupa *xuúxupa[23]	'we hit you'

But as the variants in (49) show, the speaker who applies haplology to the infinitive says **xúuxupa** 'to hit', with a falling tone on the lengthened preprefix vowel, but the speaker who applies **xu-deletion** says "**xúxuupa**" 'to hit', with a high tone on the short preprefix vowel. When **xu-deletion** applies, the prefix vowel lengthens. Otherwise haplology will cause CL in the preprefix vowel. Apparently, only **xu-deletion** can apply to a structure bearing a SP that is identical to the OP, as the SP-OP sequence does not provide the right environment for haplology. Now given that **xu-deletion** is optional, all the three identical syllables - the SP, OP, and initial syllable of -**xupa** - can surface without creating an ill-formed structure. From (49) and (50) we note that (i) not all cases of prefix-preprefix identity trigger haplology, and (ii), **xu-deletion** is optional. Notably, unlike (44)-(48) where the prefix and preprefix were co-referential, the SP's and OP's in (49) - (51) refer to different things, suggesting that for haplology to delete a prefix, the preceding preprefix must be co-referential.

(51)	**SP**	**OP**	**V-Stem**	**PR**	**Gloss**
	ßa	ßa	-lima	ßaßálima *ßaálima	'they cultivate them'
	mu	mu	-suta	mumúsuta *muúsuta	'you pl. carry him'
	xu	xu	-saßa	xuxúsaßa *xuúsaßa	'we beg you sg.'
	ku	ku	-xila	kukúxila *kuúxila	'it (cl.3) overpowers it (cl.3)'

Another set of identical prefixes worth considering occurs in relative constructions like those presented in (32b). Apparently, Bukusu forms relative constructions by affixing a relative prefix (RP) structure to the verb stem. (52a) whose simple verb structures comprise a SP and a V-Stem contrast well with their relativized counterparts in (52b).

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[23] Both haplology and **xu-deletion** apply to the infinitive of -**xupa** which has a sequence of four identical syllables - the infinitive marker, 2 sg. OP, and the initial syllable. Thus /**xu-xu-xu-xupa**/ ---> [**xúuxuupa**] 'to hit you,' where the first two are the preprefix and prefix respectively, while the third is the OP.

(52)a.

SP	V-Stem	PR	Gloss
ßa	-iča	ßéčča	'they come'
mu	-ima	mwiima	'you pl. stand'
xu	-oma	xwooma	'we dry'

b.

RP_1	RP_2	V-Stem	PR	Gloss
ßa	ßa	-iča	ßáßéčča	'those who come'
mu	mu	-ima	mumwiima	'those of you who stand'
xu	xu	-oma	xuxwooma	'those of us who dry'
u	u	-eŋa	óweeŋa	'You who wants'
xa	xa	-ißa	xaxeeßa	'that which steals'

Notice that the prefix cannot undergo haplology in (52b) because VC has already applied to the vowel to yield a long vowel whose features combine the features of the prefix- and stem-initial vowels. The prediction then is that haplology will apply to a RP when it is attached to a C-initial stem. Indeed this is what we get in (53).

(53)a.

SP	V-Stem	PR	Gloss
ßa	-xola	ßaxola	'They do'
mu	-lola	mulóla	'you pl. look'
xu	-ßira	xußira	'we pass'
u	-tima	otíma	'you sg. run'
xa	-yaßa	xayáßa	'it (cl.12) digs'
ku	-xola	kuxola	'it (cl.3) does'
si	-tora	sitóra	'it (cl.7) gets wet'
ßi	-lila	ßilíla	'they (cl.8) cry'

b.

RP_1	RP_2	V-Stem	PR	Gloss
ßa	ßa	-xola	ßaaxola	'those who do'
mu	mu	-lola	múúlóla	'those of you pl. who look'
xu	xu	-ßira	xuußira	'those of us who pass'
u	u	-tima	óotima	'you sg. who runs'[24]
xa	xa	-yaßa	xááyáßa	'that which digs'
ku	ku	-xola	kuuxola	'one which does'
si	si	-tora	síítóra	'one which gets wet'
ßi	ßi	-lila	ßíílíla	'those which cry'

Therefore, from (50) and (53) we conclude that prefix haplology applies in (53) because the two syllables of the relative prefix are co-referential. Apparently, it is also requisite for haplology that the targeted prefix be co-referential with the preceding (identical) syllable.[25]

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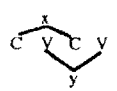
[24] This example is particularly interesting because besides showing haplology as applying to prefix structures whose prefix is identical to the preprefix, it also indicates that CL applies after initial short vowel lowering. But this creates an ordering paradox, given the first example in (33b). Therefore, we assume for now that the rule lowering the stem-initial vowel is sensitive to other aspects of the grammar.

[25] This might appear to support Hyman's suggestion (p.c.) that we treat the prefix structure targeted by haplology as a single unit, in which case the identical consonants and vowels can be treated as single segments linked to the skeleton as follows:



Here, *x* and *y* are segmental variables with *X* and *y* standing for consonants and vowels, respectively. Two reasons show that this representation is incorrect: first, given the short word-initial vowel lowering rule that applies in

To summarize, this section has examined two syllable-deleting processes. First, we reviewed **xu-deletion** in **-xupa** 'hit,' which was found to occur only after a short vowel. Secondly, we looked at haplology, which affects a prefix in case it is identical to, and co-referential with, the preceding preprefix. As both types of syllable deletion result in the compensatory lengthening of the preceding vowel, it would be interesting to examine the CV and moraic accounts for these processes. We pursue this in §4.3. Meanwhile, let us take a look at apparent exceptions to some of the processes discussed so far.

3.5 Apparent Counterexamples

We have made the following observations in the preceding discussion:

(54) i. *A high vowel becomes a glide before another vowel;*

ii. *A non-high vowel deletes before another vowel; and*

iii. *Vowel-initial stems trigger processes which alter the prefix, and as a result, block haplology.*

While (54i) summarizes the change triggered by vowel-initial stems to preceding high prefix vowels (cf.§3.1), (54ii) refers to VC, examples of which we saw in §3.2. (54iii), on the other hand, is a combination of (54i) and (54ii), since GF and VC are two of the three processes which may bleed haplology, the other being PNC (for which see §3.3). Because GF, VC, PNC, and syllable deletion are interrelated, counterexamples to one raises suspicions about the authenticity of the rest, hence the need to explain why Bukusu has vowel-initial stems which fail to trigger GF and VC.

3.5.1 Apparent Counterexamples to GF

Despite the assertion in §3.1 that high vowels undergo GF before vowels, Bukusu has numerous cases of vowel-initial stems that seem to violate this generalization. To start with, let us consider (55) where high prefix vowels fail to glide before vowel-initial stems, and consequently provide the right conditions for prefix haplology. If, as treated in §3.1, GF was exceptionless, why would the prefix vowels fail to glide in (55), acting instead as though the stems were consonant-initial? Would VC also fail to apply if the same stems took prefixes with non-high vowels? Before attempting to answer these questions, we shall first consider exceptions to all the processes discussed to this point.

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words like /u-mu-ndu/ --> [omuundu] 'a person', it is hard to defend the view that the preprefix and prefix vowels are linked to the same slot, as that would predict lowering for the prefix vowel as well. Secondly, it would be hard to motivate this representation in relative constructions where the SP and RP are clearly autonomous.

(55)a. **Infinitives**

P_1	P_2	V-Stem	PR	Gloss
xu	xu	-aaya	xuu.aaya	'to hunt'
xu	xu	-andika	xúu.aandika	'to write'
xu	xu	-ola	xúu.ola	'to rest'
xu	xu	-oča	xuu.oča	'to go on trial'
xu	xu	-ila	xúu.ila	'to send'
xu	xu	-iŋga	xuu.iiŋga	'to tighten'
xu	xu	-esya	xúu.esya	'to conceive'
xu	xu	-eela	xuu.eela	'to breathe'
xu	xu	-ula	xuu.ula	'to overpower'
xu	xu	-uula	xúu.uula	'to thresh'

b. **Nouns**

ßu	ßu	-aani	ßúu.aani	'generosity'
lu	lu	-eni	lúú.éni	'lightning'
ku	ku	-embe	kúú.éembê	'a big mango tree'
ßi	ßi	-ini	ßíí.ini	'knife handles'

c. **Adjective**

u	mu	-alaßa	ómu.alaßa	'tough (cl.1)'
li	li	-olu	líí.olu	'soft (cl.5)'
si	si	-alafu	síí.alafu	'rough (cl.7)'
ßi	ßi	-aŋgafu	ßíí.aaŋgafu	'mature (cl.8)'

3.5.2 Apparent Counterexamples to VC and Haplology

As evidence for VC applying to any non-high vowel that precedes another vowel, we cited various sets of vowel-initial stems, and as with GF, we implied that VC was exceptionless. But then there are structures like those in (56) and (57) which force us to revise our rule to avoid creating the starred variants.[26]

(56)

P_1	P_2	Stem	PR	Gloss
ßa	ßa	-aayi	ßaa.aayi *ßaßaayi	'hunters'
ßa	ßa	indi	ßáá.ĩndi *ßáßéendi	'Indians'
ku	ku	-uma	kúú.úma *kúkúúma	'fork (cl.20)'
xa	xa	-aani	xáa.aani *xáxaani	'giver (cl.12)'
ßi	ßi	-ini	ßíí.ini *ßíßiini	'knife handles'
si	si	-ilili	síí.ilili *sísiilili	'harp'
li	li	-aŋina	líí.aŋina ?lííyaaŋina[27]	'queen bee'

[26] We assume that mora-trimming would reduce input sequences of more than two moras to two.

[27] This form is rare but possible, suggesting that some speakers now analyze this as a true vowel-initial stem.

(57) **Adjectives**

P_1	P_2	Stem	PR	Gloss
ßa	ßa	alafu	ßáa.alafu *ßáßaalafu	'rough (cl.2)'
ßi	ßi	aŋgafu	ßíi.aaŋgafu *ßíßyaaŋgafu	'ripe (cl.8)'
ßu	ßu	olu	ßúu.olu *ßúßwoolu	'easy/soft (cl.14)'
ku	ku	inda	kuu.iinda *kukwiinda	'rich (cl.20)'
li	li	alaßa	líi.alaßa *lílyaalaßa	'tough (cl.5)'
si	si	umbe	síi.uumbe *sísyuumbe	'round (cl.7)'

Incidentally, haplology applies in (56) and (57) because the prefix vowels are unchanged, and so prefix-preprefix identity is present by the time haplology gets to apply. We now cite evidence to support the view that such stems are underlyingly consonant-initial.

3.6 'Ghost' Stem-Initial Consonants.

A number of studies have postulated "ghost" consonants (Archangeli 1984, 1988; Clements and Keyser 1983; and Marlett and Stemberger 1983) to account for stem-initial structures which surface with initial vowels but act as if they were consonant-initial. Before postulating the same for the stems in (56) and (57), let us consider some more sets of data.

3.6.1 The Post-Nasal Evidence

As shown in (58a) below, the 1 sg. SP, **n-**, surfaces as [n] when affixed to a vowel-initial stem. Strangely, the same nasal becomes [mb] with stems where GF and VC fail.

(58)a. Infinitive	SP	V-Stem	"I-Verb"	Gloss
xuxwaaɲǰa	n	-aɲǰa	nááɲǰa	'start'[28]
xuxwaala	n	-ala	náála	'spread'
xuxwoola	n	-ola	nóóla	'arrive'
xúxwooma	n	-oma	nooma	'dry'
xúxwiira	n	-ira	niira	'kill'
xúxwiima	n	-ima	niima	'stand'
xuxweeŋa	n	-eŋa	nééŋa	'want'
xúxweesa	n	-esa	neesa	'pass time'

[28] Ideally onset-insertion should not cause CL. Therefore the 1sg. prefix must be moraic since it triggers lengthening in the stem-initial vowel. Like GF, this is problematic for CV theory (cf.§4).

b. **Infinitive**	**SP**	**V-Stem**	**"I-Verb"**	**Gloss**
xúu.axa	n	-axa	mbaxa	'paint'
xuu.oona	n	-oona	mbóona	'drive out'
xuu.uuna	n	-uuna	mbúuna	'be punctual'
xuu.eela	n	-eela	mbɛ́ela	'breathe'
xúu.iima	n	-iima	mbiíma	'search for'
xuu.ina	n	-ina	mbína	'tease'

The difference in the behavior of the nasal before the stems in (58a) and (58b) suggests that (58b) might be underlyingly consonant-initial, given the general nasal place assimilation rule illustrated in (59).

(59) **Infinitive**	**SP**	**V-Stem**	**"I-Verb"**	**Gloss**
xuukula	n	-kula	ŋgúla	'buy'
xúuwa	n	-wa	mba	'give'
xúuβa	n	-βa	mba	'be'
xuupula	n	-pula	mbúla	'ransack'
xuučexa	n	-čexa	ɲjéxa	'laugh'
xuulola	n	-lola	ndóla	'look'

Thus besides failing to trigger GF and VC, the stem-initials in (58b) a prefixal /n-/ to [m]. Even more surprising is the "mysterious" appearance of the voiced bilabial stop, [b], between the nasal and the stem-initial vowel. These developments resolve themselves if we posit an "invisible" initial consonant for the stems in (58b), since there would be no motivation for positing a rule which epenthesizes [b]. Therefore [b] must derive from an underlying stem initial labial consonant,[29] which might have been lost by a historical rule, but whose effects still show in structures like those in (58b). (Also see fn.9).

Any one of the three labial non-vocalic segments which surfaces as [b] post-nasally, **/p, ß, w/**,[30] could fit this slot. But since stems starting with /p/ and /ß/ retain their stem-initial consonants, /w/ would be a reasonable choice. This is supported by the rareness of stem-initial /w/, as it is found in only two stems, namely **-wa** 'to give/get finished'.[31]

If the stems in (58b) do not trigger GF and VC because they have an underlying initial consonant, it can be assumed that the apparent vowel-initial stems in (56) and (57) fail to trigger GF and VC for the same reason. Apparently, a number of "aberrant" adjectives derive from the same stems as corresponding irregular verbs. (60) is illustrative.

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[29] The only other labial obstruent in the language, /f/, triggers nasal deletion like the other fricatives (cf.(36)).

[30] This post-nasal conversion to [b] does not apply to [w] derived from underlying /u/ due to ordering facts.

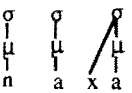
[31] As nothing depends crucially on this abstract segment being /w/, so we could assume that it is simply a C that is specified for [labial] as follows:

C
|
[Labial]

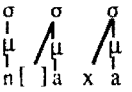
(60)	**Adjective**	**Infinitive**	**V-Stem**	**"I-Verb"**	**Gloss**
	ßáa.alafu	xuu.alala	-alala	mbálala	'get rough'
	ßíi.aaŋgafu	xuu.aaŋgala	-aŋgala	mbáaŋgala	'get ripe'
	ßúu.olu	xúu.ola	-ola	mbola	'get soft/easy'
	kuu.iinda	xúu.iindyaala	-indiala	mbiindyáala	'get rich'
	líi.alaßa	xuu.alala	-alala	mbálaßa	'get tough'
	síi.uumbe	xuu.uumba	-umba	mbúumba	'mould'

Similarly, the behavior of "aberrant" vowel-initial noun and adjective stems, can be explained by invoking 'ghost' consonants. Therefore the basic difference between "true" and "fake" vowel-initial stems is best captured by the respective underlying representations of **/n-axa/** ---> **[naaxa]** 'I stink' and **/n-axa/** ---> **[mbaxa]** 'I paint' in (61a,b) below. The square brackets in (61b) indicate the position occupied by the "ghost" consonant.

(61)a.



b.



3.6.2 The Imperative Construction

Independent motivation for "ghost" consonants comes from comparing the imperatives formed from the two types of vowel-initial stems in (56), for which see (62). In short, speakers form the imperative of true vowel-initial stems by epenthesizing [y] before the initial vowel, as in (62a). On the other hand, apparent vowel-initial stems (cf. (62b)) do not allow [y] epenthesis. Instead, they begin with the stem-initial vowel in the same way that imperatives of consonant-initial stems start with the stem-initial consonant. (See (63).)

(62)a.	**Infinitive**	**V-Stem**	**Imperative**	**Gloss**
	xuxwaaŋ̃ja	-aŋ̃ja	yaaŋ̃ja	'start!'
	xuxwaala	-ala	yaala	'spread!'[32]
	xuxwoola	-ola	yoola	'arrive!'
	xúxwooma	-oma	yooma	'dry!'
	xúxwiira	-ira	(y)iira	'kill!'
	xúxwiima	-ima	(y)iima	'stand!'
	xuxweeŋa	-eŋa	yeeŋa	'want!'
	xúxweesa	-esa	yeesa	'pass time!'

[32] Oddly, epenthetic [y] triggers lengthening in the stem-initial vowel. This is problematic even for the moraic theory, because, if we assume like Hayes (1989) that glides are non-moraic, there is no reason why epenthentic [y] should trigger lengthening in the following vowel. Treating this as [i] insertion is untenable, as it seems strange for onset insertion to insert a vowel before another vowel [Itô 1989].

b.

Infinitive	V-Stem	Imperative	Gloss
xúu.axa	-axa	axa	'paint!'
xuu.aaya	-aaya	aaya	'hunt!'
xuu.oona	-oona	oona	'drive out!'
xúu.ona	-ona	ona	'heal (intr.)!'
xuu.uuna	-uuna	uuna	'be punctual!'
xuu.una	-una	una	'stab!'
xuu.eela	-eela	eela	'breathe!'
xúu.ela	-ela	ela	'perish!'
xúu.iima	-iima	iíma	'search for!'
xuu.ina	-ina	ina	'tease!'

(63)

Infinitive	V-Stem	Imperative	Gloss
xuukula	-kula	kula	'buy!'
xúusila	-sila	sila	'be silent!'
xuulaaŋga	-laŋga	laaŋga	'call!'
xuuterema	-terema	terema	'tremble!'
xuukukuma	-kukuma	kukuma	'rumble!'
xuunyaala	-nyala	nyaala	'dry up!'

This further evidence from imperatives confirms that vowel-initial stems which fail to trigger GF and VC have "invisible" initial consonants. Therefore the earlier claim that vowel-initial stems cause preceding high vowels to glide and non-high vowels to delete remains valid. Let us now examine the implications of these facts for both the CV and moraic theories.

4.0 **Evaluation of the Theories**

This section examines the CV and moraic theories in view of the Bukusu facts presented so far, primarily because we want to determine which of the two theories is sufficiently constrained to make the right predictions regarding CL. Since both theories account for garden-variety GF, VC, and PNC, this section will focus on various problems. First, we shall consider the case of gliding word-initial prefixes, starting with the CV account and then the alternative moraic account. Secondly, we shall examine how the two theories handle syllable deletion as a trigger for CL. This should enable us to propose the theory that makes more general claims about the different sources of CL.

4.1 **The Theories**

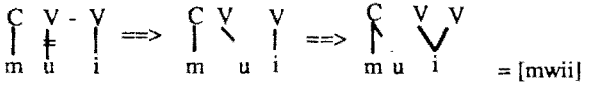
Since Clements (1986:40) treats both Cs and Vs as the units which characterize the timing tier, it is reasonable to consider the predictions that CV theory make regarding various sources of CL. Additionally, we need to contrast these predictions with those of the moraic theory, which differs from CV theory in its recognition of the basic difference between Cs and Vs, the latter of which assigns prosodic value, while treating the former as prosodically insignificant. Given this basic difference, we shall first show how each theory handles GF, VC, and PNC. Then the focus will turn to the problematic cases.

4.2 **Derivations**

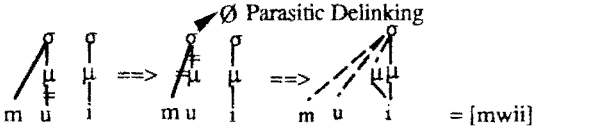
It has been claimed already that both CV and moraic theory can account for most cases of GF, VC and PNC. For instance, there is GF of the type depicted in (64).

(64). *GF and CL* - /mu-ič**a**/ ---> [mwíč**a**] 'you (pl.) come'

a. *CV Account*[33]



b. *Moraic account*



In both accounts, (64a) and (64b), GF triggers CL by delinking an underlying high vowel from its prosodic slot. Then follows resyllabification where the delinked element(s) attach to new positions, since the initial delinking would have produced a syllable that does not dominate a nucleus. As Hayes points out, such a syllable deletes by rule (65).

(65) *Parasitic Delinking* [Hayes 1989:268]

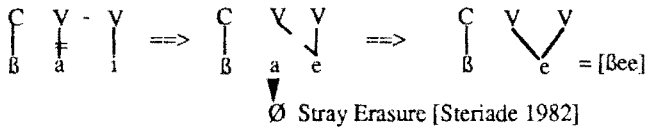
a. Syllable structure is deleted when the syllable contains no overt nuclear segment.

b. 

The other process that the CV and moraic theories handle adequately well is vowel contraction, as illustrated in the following derivation of **/ßa-iße/** ---> **[ßeeße]** 'they steal,' where /ße/ is the SP. Apparently, a rule of [hi] spreading spreads the height value of the first vowel to the following vowel before the first vowel undergoes deletion.

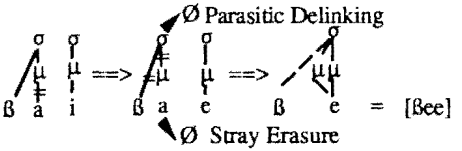
(66) *VC and CL* - /ßa-iße/ ----> [ßeeße] 'they steal'

a. *CV Account*



[33] It might be argued that the output of CV derivation in (64a) could very well be interpreted as comprising a complex segment that is primarily a bilabial nasal, and secondarily a velar glide. Since no measurements have been carried out to establish the status of this sequence, we shall let the matter rest for now.

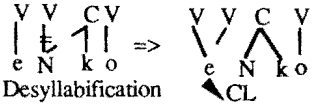
b. *Moraic Account*



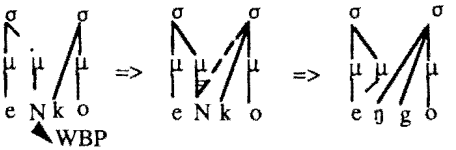
Lastly, PNC applies to any vowel occurring before a nasal-consonant sequence (cf.§3.3), as shown in the following derivation of /e-n-ko/ ---> [éeŋgo] 'at home' in (67).

(67). *PNC and CL*

a. *CV Account*



b. *Moraic Account*



Given (64)-(67) one would imagine that the two theories have equal predictive power regarding CL. However, further evidence reveals that CV theory is flawed in a way that moraic theory is not. We highlight this weakness in the next section.

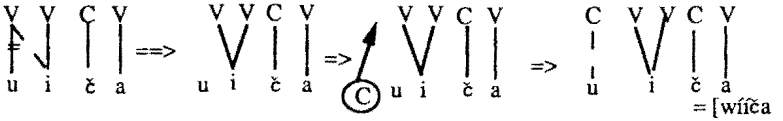
4.3 **Problematic Cases**

Three basic phenomena stand out as being problematic for CV . First, there is the problem posed by gliding syllable-initial vowels. Secondly, syllabic word-initial nasals produce effects that are quite similar to those of gliding syllable-initial vowels. Lastly, CV theory is not equipped to handle CL from syllable deleting processes with as much simplicity as it does in cases involving GF, VC, and PNC. We now turn to these processes.

4.3.1 **Gliding Vowel Prefixes**

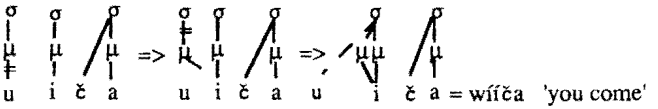
As observed before, Bukusu exhibits changes like **/u-ič̆a/** ---> **[wíič̆a]** 'you sg. come', where a prefix vowel glides before a stem-initial vowel. In the CV account in (68), C-epenthesis is postulated to provide a locus for the delinked vowel, which now becomes a glide.

(68)*CV Account* - /u-ič̆a/ ----> [wíič̆a] 'you (sg.) come'



However, this account is untenable since nothing in the theory predetermines that a C gets epenthesized, and not a V, after [u] has delinked from its slot. C-epenthesis violates the principle of "prosodic conservation", which says that rules targeting segments do not necessarily affect prosodic structure, and which both explains why segment deletion causes CL, and why we do not find spontaneous C and V lengthening. Contrast this with (69).

(69) *Moraic Account*



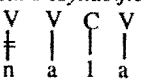
4.3.2 CL from 1 sg. SP Nasal

Data (58a), repeated below as (70) for ease of reference, pose a similar for CV theory as the one posed by gliding vowel prefixes (cf.§4.1.2). (X = gloss)

(70) **Infinitive**	**SP**	**V-Stem**	**"I X"**	**Gloss**
xuxwaala	n	-ala	náála	'spread'
xuxwoola	n	-ola	nóóla	'arrive'
xúxwooma	n	-oma	nooma	'dry'
xúxwiira	n	-ira	niira	'kill'
xúxwiima	n	-ima	niima	'stand'
xuxweeŋa	n	-eŋa	nééŋa	'want'
xúxweesa	n	-esa	neesa	'pass time'

Stem-initial vowel lengthening after the 1sg. SP comes as a surprise because onsets do not generally cause the following nucleus to lengthen. However, following Clements (1986), we can assume that the nasal is underlyingly syllabic, in which case a form like [**náála**] 'I spread' starts out as (71), with the nasal linked to V.

(71) *Nasal Desyllabification*



Apparently, the nasal desyllabification results from a general prohibition against syllabic onsets (Hyman 1984). The "floating" V reassociates to the following nucleus to leave the nasal without a skeletal locus, as in (72). Thus a C-slot is epenthesized in the same fashion as the undesirable C-slot insertion encountered in (68) for the nasal to dock on.

(72) *CL & C-Epenthesis*

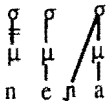
Notice here that if CL results from prosodic conservation, then slot insertion defeats the purpose of CL, which is to preserve the timing units found at the underlying level.

Moraic theory could treat postnasal lengthening as illustrated in the following representation of the change from **/n-eɲa/** to **[nééɲa]** 'I want'. First, the nasal demoraifies and releases a mora that reassociates to the stem-initial vowel. Then the "floating" nasal attaches directly to the syllable, since onsets have no prosodic value; (73c) is illustrative.

(73)a.

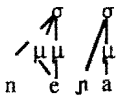
Nasal Demoraification

b.



Parasitic Delinking

c.



Nasal Reassociation
&
Compensatory Lengthening

= nééɲa 'I want'

Crucially, the number of moras remains the same throughout the derivation in (73), which indicates that moraic theory conforms to the principle of prosodic conservation.

4.3.3 **Syllable Deleting Processes**

Two syllable-deleting processes were presented in §3.4, both of which caused a preceding vowel to lengthen compensatorily. For instance, it was shown that subject and infinitive prefix vowels lengthen because of the deletion of the first syllable of **-xupa** 'hit', to give forms like **[aapa]** 's/he hits' and **[xúxuupa]** 'to hit' from underlying **/a-xupa/** and **/xu-xu-xupa/**, respectively. Obviously, the deletion affects the entire syllable as the only trace of **xu** after the deletion is the lengthened vowel of the preceding syllable.

To appreciate fully the implication of syllable deletion for CV theory, recall that, despite Clements and Keyser's (1983) claim that only vowels function as loci for prosodic

properties, CV theory considers Cs and Vs to be prosodically equal since both function as timing units, as in the following representation of **/a-xupa/** 's/he hits'.

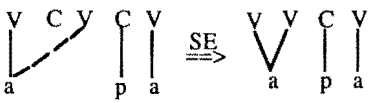
(74) *Underlying Representation*

Now given that **xu-deletion** eliminates the entire first syllable (cf. (40)), we can further assume that the process only targets the segments, leaving the CV tier intact, in which case **xu-deletion** yields (75), where the floating C and V lack segmental material. Potentially, the floating C can reassociate to the preceding nucleus, while the V can form a VC syllable with the following onset. However, this is blocked by the preferred syllable structure constraints of the language.

(75) *Xu - Deletion*

But assuming, like Marantz (1982), that only Vs attach to [+syll] segments, an argument could be made that only the V is capable of relinking to preceding [a]; then C deletes by Stray Erasure [Steriade 1982], as in (76). Does this rest the case for CV theory?

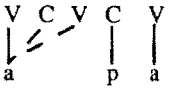
(76)



The irony of this elegant analysis, however, is that it provides a good argument in favor of a moraic approach, because it makes clear the fact that CV theory only recognizes Vs as having prosodic value, not Cs. If the purpose of postulating both Cs and Vs as prosodic units is to have them count as timing slots, then adding stipulations that prevent Cs from participating in prosodic processes is an admission that their inclusion in the prosodic structure was unfounded. In other words, placing Cs in the prosodic tier without assigning them any prosodic function defeats the purpose of having them there. Note also that if the prohibition against Cs associating to [+syll] slots were followed strictly, there would be no principled justification for syllabic nasals in the CV framework, since nasals are inherently [-syll]. Moraic theory does not need these extra stipulations, since it treats Cs as having no prosodic value, except that which is assigned by rule.

One suggestion is that perhaps both C and V reassociate to the preceding syllabic segment, as in (77). Then follows mora trimming (Clements (1986:57)),[34] as in (78).

(77) *Possible Reassociation*



(78) *V- Trimming (generalized)*

V_Q --> Ø / ____ V V

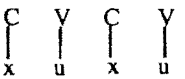
Subscript "Q" refers to any number of Vs in excess of the permissible two.

However, (77) does not have the right configuration for (78), since the former has C in its configuration, while (78) trims any V followed by two Vs.

As our aim is to show that CL from syllable deletion is problematic for CV theory, which must make extra stipulations referring to the unique features of Cs and Vs to avoid generating wrong outputs, let us examine haplology, another type of syllable deletion.

Haplology operates like **xu-deletion**, since it also deletes an entire (prefix) syllable in case it is identical to the preprefix. The infinitive in (79) is illustrative.

(79) *Prefix-Preprefix Identity*



But how can we tell that haplology does not just delete the onset C of the prefix? After all, this would put the two Vs adjacent to each other, as in the examples in §3.4.2. The motivation for postulating syllable-deletion comes from the fact that onset-deletion would not necessarily render the syllable ill-formed, since Bukusu phonology licences onsetless syllables. For instance, we see from (80) and the respective structures in (81) that Bukusu contrasts adjacent heterosyllabic moras with identical tautosyllabic moras. (The period is a syllable break.) Bukusu speakers treat the output of haplology as having structure (81a) rather than (81b).

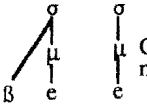
(80)	xu-xu-ßeela	xúu.ßee.la	'to forgive'
	xu-xu-ßeela	xúu.ße.ela	'to accuse falsely'
	xu-xu-ßuula	xúu.ßuu.la	'to reveal'
	xu-xu-ßuula	xúu.ßu.ula	'to overpower it (cl.14)'
	xu-xu-ßiila	xúu.ßii.la	'to send them (cl.8)'
	xu-xu-ßiila	xúu.ßi.ila	'to hate'

[34] This suggestion was made by a colleague during a seminar presentation of a portion of my data.

(81) a.

Contiguous tautosyllabic moras

b.



Contiguous heterosyllabic moras

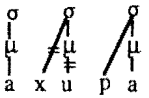
Therefore what is needed in the case of haplology is not just the creation of a CVV sequence; rather it is necessary that the rule eliminate the whole syllable so as to set free the prosodic slot needed for CL. The fact that the speaker-intuition is that haplology creates a single bimoraic syllable supports our analysis.

Therefore just as it was unable to account for the syllable deletion in **-xupa** without resorting to undesirable stipulations, CV theory fails to account for CL from haplology. Therefore we need to consider the alternative account offered by moraic theory.

5.3.3.2 **The Moraic Account**

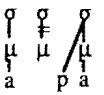
One of our strongest arguments in favor of a moraic analysis of Bukusu prosodic structures comes from its predictions regarding syllable deletion and the CL thereof. Since only coda Cs receive *weight by position* (WBP = Hayes 1989:258) in this framework, while onsets have no loci in the prosodic tier, the theory predicts that a rule like haplology which targets the second of two co-indexed syllables, culminates in CL since rules targeting the syllable tier do not necessarily affect prosodic structure. Thus the change from **/a-xupa/** to **[aapa]** 's/he hits', for instance, is derived in the following stages.

(82)a.



xu - deletion

b.



Parasitic Delinking

c.

Compensatory Lengthening

= aapa 'he hits'

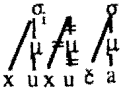
The lengthened SP vowel attests to Hayes' (1989:285) principle of mora conservation.

Similarly, prefix haplology can be illustrated by display (83), which captures the derivation of **[xúuča]** 'to go' from **/xu-xu-ča/**. (Subscript *i* marks identical syllables.) As indicated by (83b) unassociated segments delete by Stray Erasure.

(83)a.

Prefix Haplology

b.



Stray Erasure

c.

Mora Reassociation
= CL

= xúuča 'to go'

What is appealing about this account is its simplified, but intuitively correct, treatment of several processes which yield CL. This greater predictive power derives from its treating Cs as prosodically valueless, in contrast to Vs which attach to timing positions.

4.4 **Summary and Conclusion**

Our goal in this study has been to use the Bukusu facts to try and determine the theory that makes more accurate predictions about segment changing processes and CL. Although both theories account for basic GF, VC and PNC satisfactorily, the CV theory encounters problems with processes that moraic theory handles without difficulty. Apparently, these problems result from its failure to separate the skeleton from the prosodic tier. While the Bukusu evidence cannot be used as the sole premise for judging the adequacy of either theory, the evidence from the three problematic cases presented above has favored the moraic approach, hence the acceptance of Hyman's (1984) (also Hayes' 1989:254) claim about onsets being invisible to some phonological rules as a step in the right direction.

While it is true that recent work on Hungarian and Moroccan Arabic, to name just two, shows that moraic theory does not answer satisfactorily the perennial question concerning the elements which constitute the timing tier, the Bukusu facts presented above show that any theory which fails to recognize that consonants are prosodically valueless is too powerful. Perhaps what we need is a theory that treats the skeleton as separate from the moraic tier, but includes both in phonological representations. As of now, the predictions made by the moraic theory in a language like Bukusu cannot be ignored.

5.0 [y] - epenthesis - A Case for Further Research

The preceding sections have shown that moraic theory distinguishes consonants and vowels by treating the later as inherently moraic, and the former as non-moraic. CV theory, on the other hand, does not recognize a separate prosodic tier from the skeletal tier. In the moraic theory, all non-vocalic sonorants behave like regular consonants unless otherwise stipulated by particular languages. The prediction then is that glides should not cause adjacent vowels to lengthen. However, just as data (58a) forced us to revise a similar assump-tion about nasals, evidence can be adduced to disprove our prediction about glides.

This evidence is seen in the imperative constructions in (62a), repeated below as (84), where the epenthetic [y] causes lengthening in the stem initial vowel.

(84)

Infinitive	V-Stem	Imperative	Gloss
xuxwaaŋ̆ja	-aŋ̆ja	yaaŋ̆ja	'start!'
xuxwaala	-ala	yaala	'spread!'
xuxwoola	-ola	yoola	'arrive!'
xúxwooma	-oma	yooma	'dry!'
xúxwiira	-ira	(y)iira	'kill!'
xúxwiima	-ima	(y)iima	'stand!'
xuxweeŋa	-eŋa	yeeŋa	'want!'
xúxweesa	-esa	yeesa	'pass time!'

Clearly, (84) is problematic because, while it is possible to speak of moraic nasals within autosegmental phonology, one cannot argue convincingly that epenthetic [y] is syllabic (= moraic), since syllabic glides automatically change to corresponding high vowels. The question here then is how to account for the lengthening that follows [y]-epenthesis, since syllabicity cannot be invoked as the trigger. But if we assumed, for lack of a better explanation, that the glide was underlyingly /i/, the epenthesis would violate Itô's (1989) Onset Principle (see (85)). How then does one account for lengthening from [y]-epenthesis?

(85) *Onset Principle*

Avoid $_{\sigma}$[V

CV phonology would probably handle the change from **/y-ola/** to **[yoola]** 'arrive!' as involving V-insertion such that the inserted V functions as both the onset and the initial mora of the syllable to which it belongs, as in configuration (86):

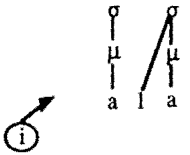
(86)

But we lack motivation for this sort of representation.

The problem is equally hard for the moraic theory because it treats glides differently than high vowels by assuming that they are non-moraic. This means that (84) cannot be

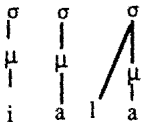
explained unless we accept that the epenthesis involves [i] which later glides before the stem-initial vowel. Thus if we ignore the onsetless principle and assume that imperative construction involves [i] insertion, the change from **/i-ola/** to **[yoola]** 'arrive!' will proceed as in (87). But why insert a vowel when the structure needs an onset?

(87)a.



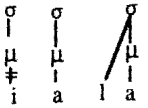
Epenthesis

b.



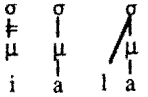
Mora Assignment

c.



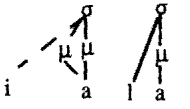
Glide Formation

d.



Parasitic Delinking

e.



CL and Onset Insertion

= yaala 'spread!'

Although the moraic theory seems to have greater predictive power than the CV theory with respect to CL, the proposed treatment of CL from glide epenthesis cannot be defended on any principled grounds as it violates the onsetless principle without proper justification. Thus in trying to answer one question, we have raised another problem: How should we modify the current non-linear theories so as to account for CL from epenthesized glides?

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